Introduction

Coronary artery disease is blockage in the heart arteries. It's caused by chronically progressive **atherosclerosis** (the plaque) that obstructs the lumen, decreasing the ability of the arteries to perfuse the myocardium. This produces ischemia when cardiac demand increases; there's an imbalance in the demand to supply ratio. For these conditions, both reperfusion (getting rid of the plaque) and reducing the workload of the heart will improve symptoms. When an **acute thrombus** forms from endothelial injury the lumen can quickly become occluded, resulting in a **supply ischemia**; no amount of demand reduction will save this tissue. Reperfusion is required to prevent myocardial death.

The spectrum of coronary artery disease begins with **stable angina** where the coronary artery disease is known and the patient knows how far they can go before symptoms start. **Unstable angina** is worsening of symptoms with less work, more pain with the same work, or pain refractory to nitroglycerin. **NSTEMI** is still demand ischemia, but there's elevation of the troponins. **STEMI** implies acute thrombosis and transmural infarct.

Risk Factors

CAD is just vascular disease in the heart arteries; the risk factors are the same for all vascular disease. **Diabetes**, **Smoking**, **Hypertension**, **Dyslipidemia**, and **Obesity** are **modifiable** risk factors. **Age** (M > 45, F > 55) and **family history** of early vascular disease are **non-modifiable** risk factors.

Patient Presentation

The Diamond classification identifies patients' risk of coronary artery disease based on the symptoms. There are three components. [1]**Substernal** chest pain, [2] **Worse with Exertion**, and [3]**Better with Nitroglycerin**. 3/3 is called typical, 2/3 is called atypical, and 0-1 is called non-anginal. The more positives, the higher the likelihood that this chest pain is anginal. The classic description is a **crushing**, **retrosternal chest pain** that will **radiate down the arm** and **up the jaw**.

Associated symptoms are also useful. The presence of **dyspnea, nausea/vomiting**, or **diaphoresis** with the onset of the chest pain increases the suspicion of myocardial ischemia.
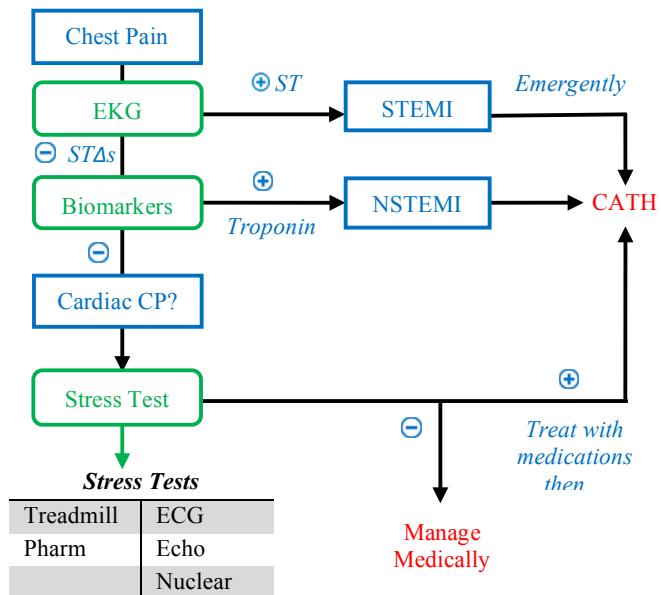
Consequences of the infarct may also be identified. **Congestive heart failure** (pulmonary edema, JVD, poor distal perfusion) and **arrhythmia** (especially heart blocks and ventricular tachycardia) can be seen, but are often absent.

Diagnosis

Rule out the most severe disease (STEMI) first with a **12-Lead ECG** looking for **ST-segment elevations** or a new **LBBB.** STEMI goes to **emergent cath.** If negative rule out NSTEMI with biomarkers (**Troponin-I**). NSTEMI goes to **urgent cath.** If both the troponins and the ECG are negative, you're left considering if this pain is coronary in nature at all. This can be determined using the stress test. If the stress test is positive, go to **elective cath.**

	Stable Angina	*Unstable Angina*	*NSTEMI*	*STEMI*
Pain	Exercise	@ rest	@ rest	@ rest
Relief	Rest + Nitrates	Ø	Ø	Ø
Biomarkers	Ø	Ø	↑	↑
ST Δs	Ø	Ø	Ø	↑
Pathology	70%	90%	90%	100%

Sxs	*Assoc Sxs*	*Risk Factors*
1. Substernal	Dyspnea	Diabetes
2. Exertional	N/V	Smoking
3. Relieved with NTG	Presyncope	HTN
		HLD
3/3 = Typical		Family Hx
2/3 = Atypical		Age > 45 M > 55 F
0-1 = Nonanginal		

Treadmill	ECG
Pharm	Echo
	Nuclear

Stress Tests

If the person **can't walk** for any reason, use pharmacologic stress (either dobutamine or adenosine)

If the person has a **normal ECG**, use ECG
If the person has an **abnormal ECG**, use Echo
If the person has an **abnormal Echo** or CABG, use Nuclear

Diagnostic Modalities

1. The **stress test**

Regardless of the mechanism used, it's looking for the same thing: evidence of ischemia under stress. The goal is to get the patient to target heart rate (85% of their maximum) and have them sustain it. The test is positive if there's chest pain during stress or the imaging modality is positive. For **ECG** test, look for ST segment changes (T wave inversion or ST segment elevations). For the **Echo,** look for **dyskinesia** (also called akinesis) that's present on stress but absent at rest (this is at-risk but not dead tissue). **Nuclear** stress tests demonstrate perfusion with Thallium. The reversibility (normal perfusion at rest, compromised with stress) identifies salvageable tissue. Whenever the stress test is positive, the next step is catheterization.

2. **Catheterization**

This is the **best test** for the diagnosis of coronary artery disease. It assesses the **severity of stenosis** AND helps rule out **Prinzmetal's angina** (clean coronary arteries producing ischemia as a product of vasospasm - treat with CCB).

Acute Treatment

Patients presenting with angina need **Aspirin**, first and foremost. **Nitrates** can be given to alleviate pain, but must be avoided in right-sided infarcts (II, III, AvF). **Beta-blockers** reduce myocardial work and prevent ventricular arrhythmias (the thing that kills patients in the first 24 hours). **ACE-inhibitors** have long term benefits. **Statins** are the mainstay of therapy for cholesterol. If it's certain this is Acute Coronary Syndrome, **therapeutic heparin** and **clopidogrel load** should be used as well. Oxygen and morphine are used prn.

Interventional management choices are **Stent** or **CABG**. The decision is made based on the severity of occlusive disease. If it's really bad (i.e. requires multiple stents) do a CABG. If the atherosclerosis is global, distal, or microvascular then **medical management only** may suffice.

For thrombolysis, either the administration of **tPA** (within **12 hours** of onset) or **heparin** is done only when catheterization is not available <u>AND</u> they're in an acute disease (STEMI).

Chronic Therapy

1. *Adjust risk factors*
   a. <u>LDL</u> – **High potency statin**. Old LDL goal < 100. Now, start statin.
   b. <u>DM</u> – tight glucose control to near normal values (**80-120 or HgbA1C < 7%**) with oral medications or insulin.
   c. <u>HTN</u> – regular control of blood pressure to **<140 / <90** with **Beta-Blockers** (reduce arrhythmias) and **ACE-inhibitors.** Titrate heart rate to between 50-65 bpm and 75% of the heart rate that produced symptoms on stress test.
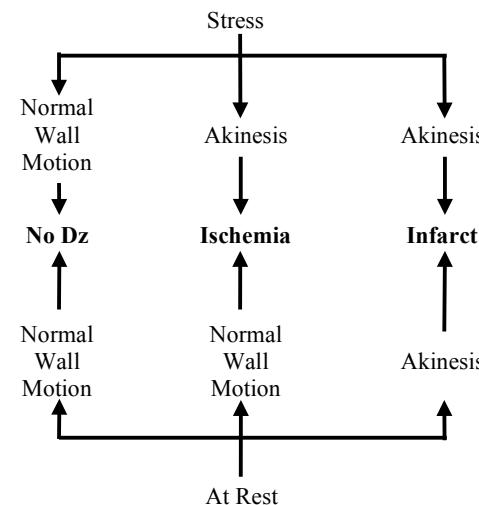2. *Reduce Risk of Thrombosis*

   Aspirin (Cox-Inhibitor) is the standard therapy. **Clopidogrel** (ADP-inhibitor) can be used if ASA allergy.

Can't Exercise: Peripheral Vascular Disease, Claudication, vasculitis, diabetic ulcers, SOB at rest, etc.
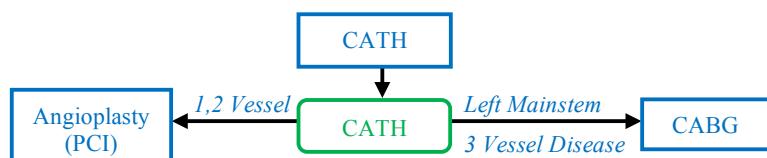
Can't Read ECG: Any BBB or old infarct

"Dead Things Don't Move"

Acute Presentation: MONA-BASH

Morphine	**B**eta-Blocker
Oxygen	**A**CE-inhibitor
Nitrates	**S**tatin
Aspirin	**H**eparin

Indication	*Duration*
Drug Eluding Stent	Clopidogrel x 12 months
Bare Metal Stent	Clopidogrel x 1 month
Angioplasty Alone	No Clopidogrel

Treatment	*When to use it*	*Goals*	
Statins	Any ACS	LDL < 70	HDL > 40
β-Blockers	Any ACS	SBP < 140	DBP < 90
ACE-i	Any ACS	SBP < 140	DBP < 90
ASA	Any ACS	No goal	
Clopidogrel	ASA allergy or stents	No goal	
Angioplasty	ST↑ or + Stress; 1 or 2 vessel disease		
CABG	ST↑ or + Stress; Left-Mainstem <u>or</u> 3 vessel disease		
tPA	ST↑; no PCI available, no transport		
Heparin	ST↑ or + Stress; contraindication to tPA		

Surgery = Left Mainstem <u>OR</u> 3-vessel disease; surgery = CABG
Angioplasty = 1,2 Vessel Disease